



Surface and Atmosphere Geochemical Explorer



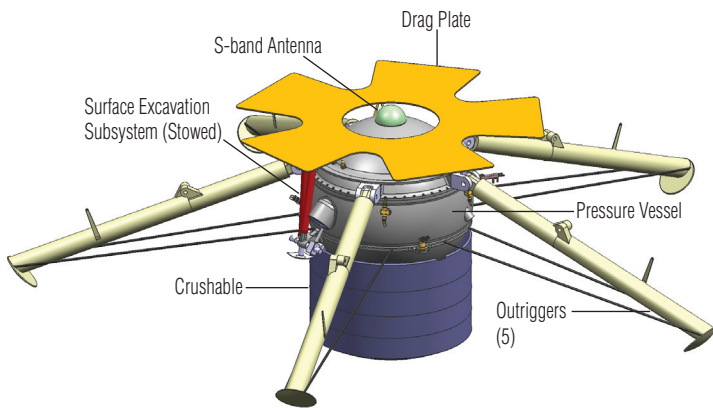
The Surface and Atmosphere Geochemical Explorer (SAGE) is a Venus mission designed to study the history of the atmosphere, climate, and surface to compare Venus to Earth and to extrasolar planets. SAGE would tell us about the history of Venus, why Venus is so different from Earth, and what this can tell us about Earth's fate. SAGE would inform us about extrasolar planets discovered by Kepler and other surveys. SAGE would be constructed to survive the harsh conditions on Venus for 3 hours or more — the surface pressure on Venus is 100 times that of Earth and the temperature is similar to that of a self-cleaning oven. The Lander would descend onto the flank of a possibly active volcano, Mielikki Mons.

Mission at a Glance

- Trajectory—short duration, flyby, 136 days maximum
- Launch—December 2016, 21-day launch period
- Separation—April 2017, 5 days before descent
- Descent—May 2017, 1 hour
- Landing site: Mielikki Mons
- Surface science: 3 or more hours

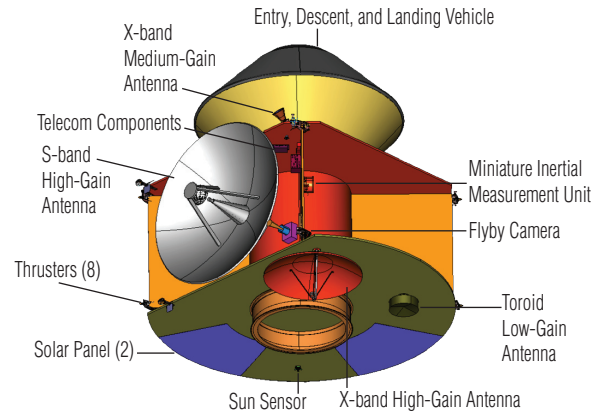
Objective/Instrument	Measurements	Provider
Atmospheric Dynamics <ul style="list-style-type: none">• Flyby Camera (FBC)• Atmospheric Structure Investigation (ASI)	<ul style="list-style-type: none">• Ultraviolet and near-infrared imaging for entry context and cloud dynamics• Temperature, pressure, dynamics, and wind speed	<ul style="list-style-type: none">• Space Research Institute of the Russian Academy of Sciences• NASA Ames Research Center
Atmospheric Composition <ul style="list-style-type: none">• Tunable Laser Spectrometer (TLS)• Neutral Mass Spectrometer (NMS)	<ul style="list-style-type: none">• Stable isotope ratios• Measure major, trace, and noble gas species	<ul style="list-style-type: none">• Jet Propulsion Laboratory, California Institute of Technology• NASA Goddard Space Flight Center
Surface Geology and Weathering <ul style="list-style-type: none">• Descent and Panoramic Cameras (DPC)• Microscopic Camera	<ul style="list-style-type: none">• Descent and surface imaging• Imaging of Raman/LIBS site	<ul style="list-style-type: none">• Malin Space Science Systems• Malin Space Science Systems
Surface Composition and Mineralogy <ul style="list-style-type: none">• Neutron-Activated Gamma-Ray Spectrometer (NAGRS)• Raman and Laser-Induced Breakdown Spectroscopy (LIBS)	<ul style="list-style-type: none">• Major, minor, and trace surface and subsurface elements• Surface and subsurface minerals and elements	<ul style="list-style-type: none">• Space Research Institute of the Russian Academy of Sciences• Los Alamos National Laboratory

SAGE Spacecraft Lander and Carrier



Lander

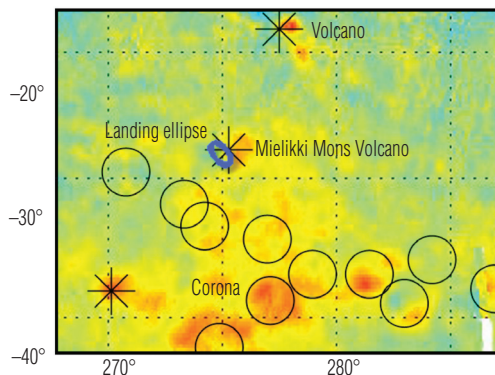
- Atmospheric measurements to the surface
- First-time nested descent images
- Active and passive analysis of the surface and subsurface
- Standard temperature and pressure on the surface within the Lander pressure vessel
- Environmental testing verifies Venus surface operations



Carrier

- Mars Reconnaissance Orbiter and Gravity Recovery and Interior Laboratory heritage and design commonality hardware and software, including fault protection
- Compatible with Atlas V and Delta IV launch vehicles
- Three-axis stabilized with coupled thrusters
- Receives, stores, and retransmits science observations
- X-band Earth downlink uses only 34-meter Deep Space Network antennas
- S-band link between Lander and Carrier for reliable data transmission

SAGE Landing Site



The SAGE landing site is on the flank of one of Venus's many volcanoes. High-emissivity regions (red) are interpreted to be areas where lava flows are relatively recent.

SAGE Team

- Principal Investigator—Dr. Larry Esposito, Laboratory for Atmospheric and Space Physics, University of Colorado at Boulder
- Laboratory for Atmospheric and Space Physics, University of Colorado at Boulder—Science Leadership, Science Data Archive, Education and Public Outreach
- Jet Propulsion Laboratory, California Institute of Technology—Project Management, Project Systems Engineering, Mission Management, Lander, Entry-Descent-Landing
- Lockheed Martin—Carrier, Entry and Extraction Subsystem, Integrated Flight System Assembly, Test, and Launch Operations
- NASA Ames Research Center and NASA Langley Research Center—Technical support for Venus atmospheric entry and descent

National Aeronautics and Space Administration

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For more information about SAGE, go to:

<http://sagemission.jpl.nasa.gov/>